



The Future is Now

JPL and the Innovation Ecosystem

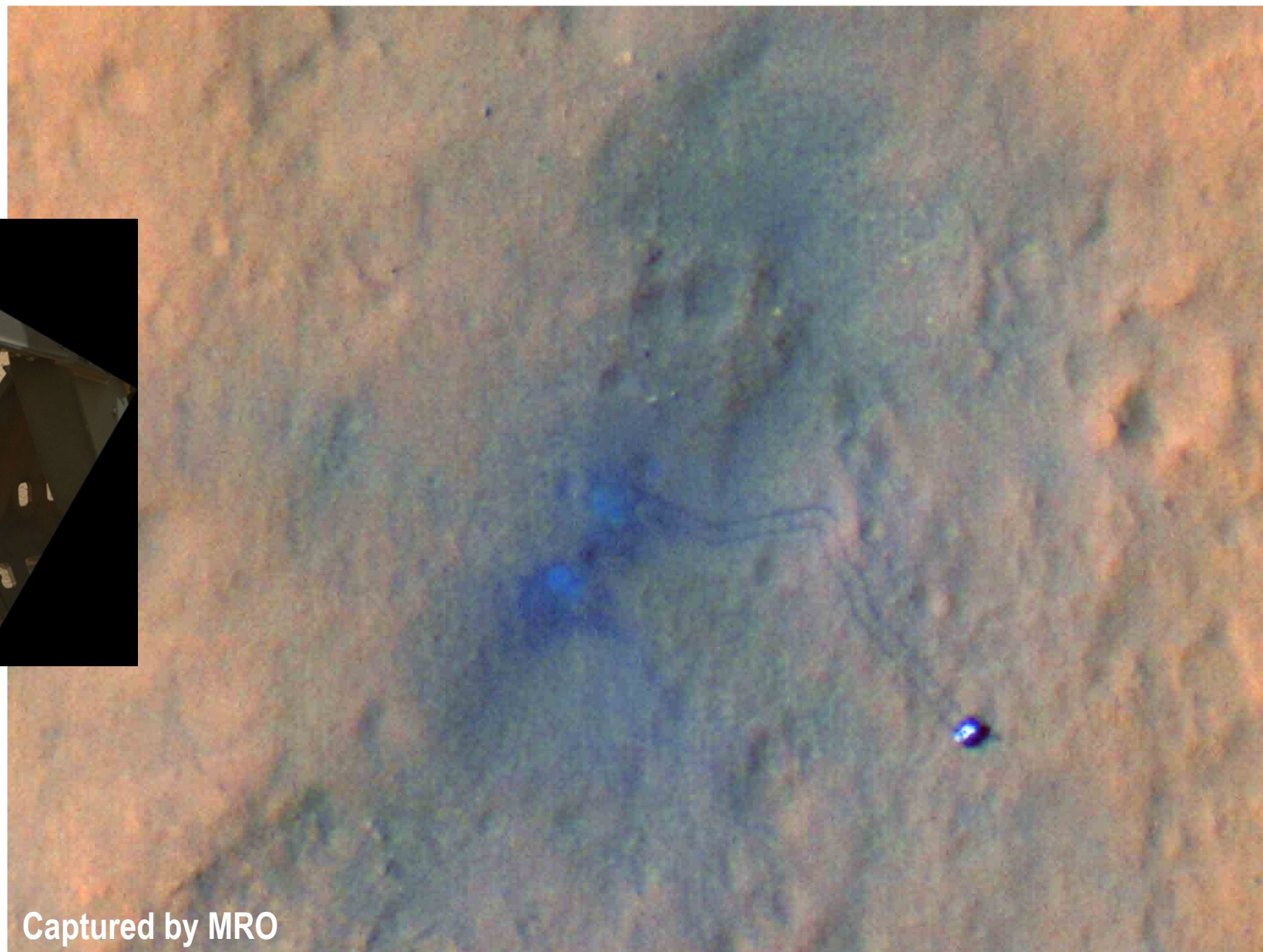
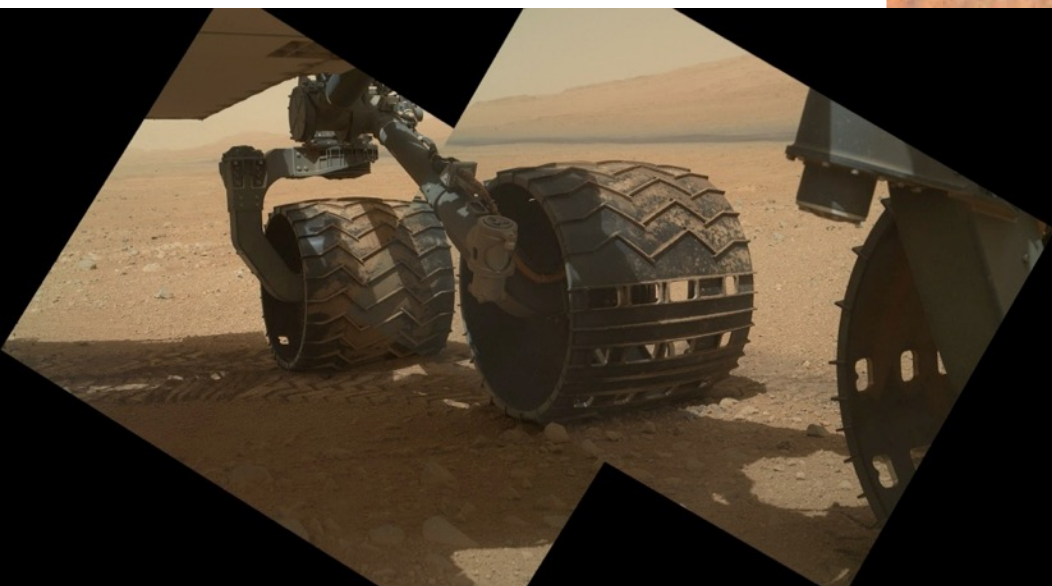
Tom Cwik
Jet Propulsion Laboratory
California Institute of Technology

March 15, 2018

Starburst Accelerator
Pasadena CA

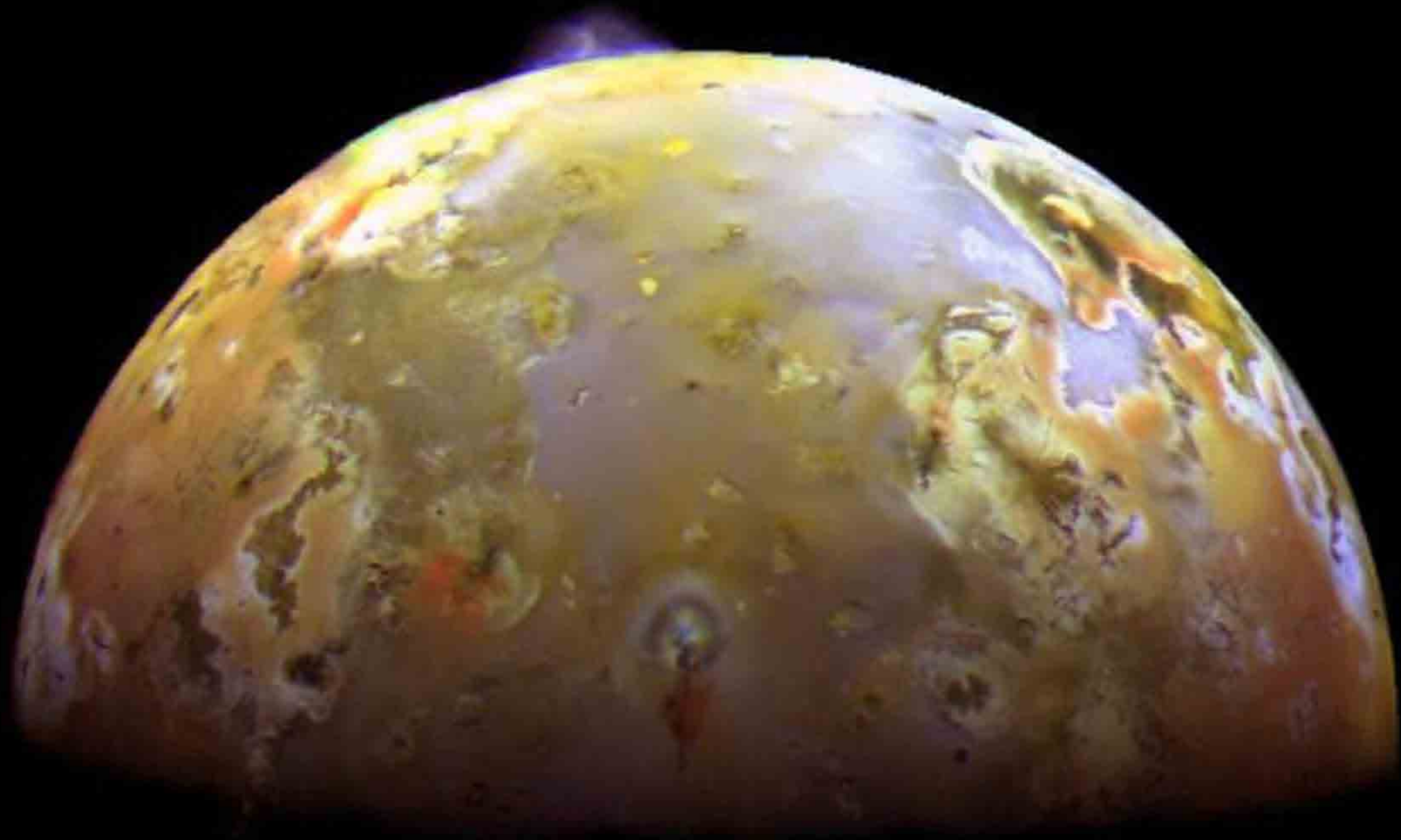


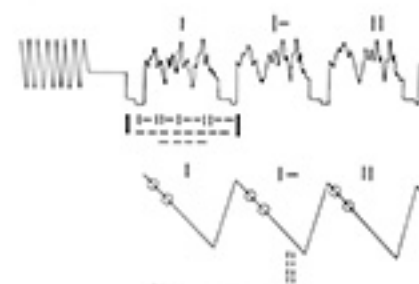
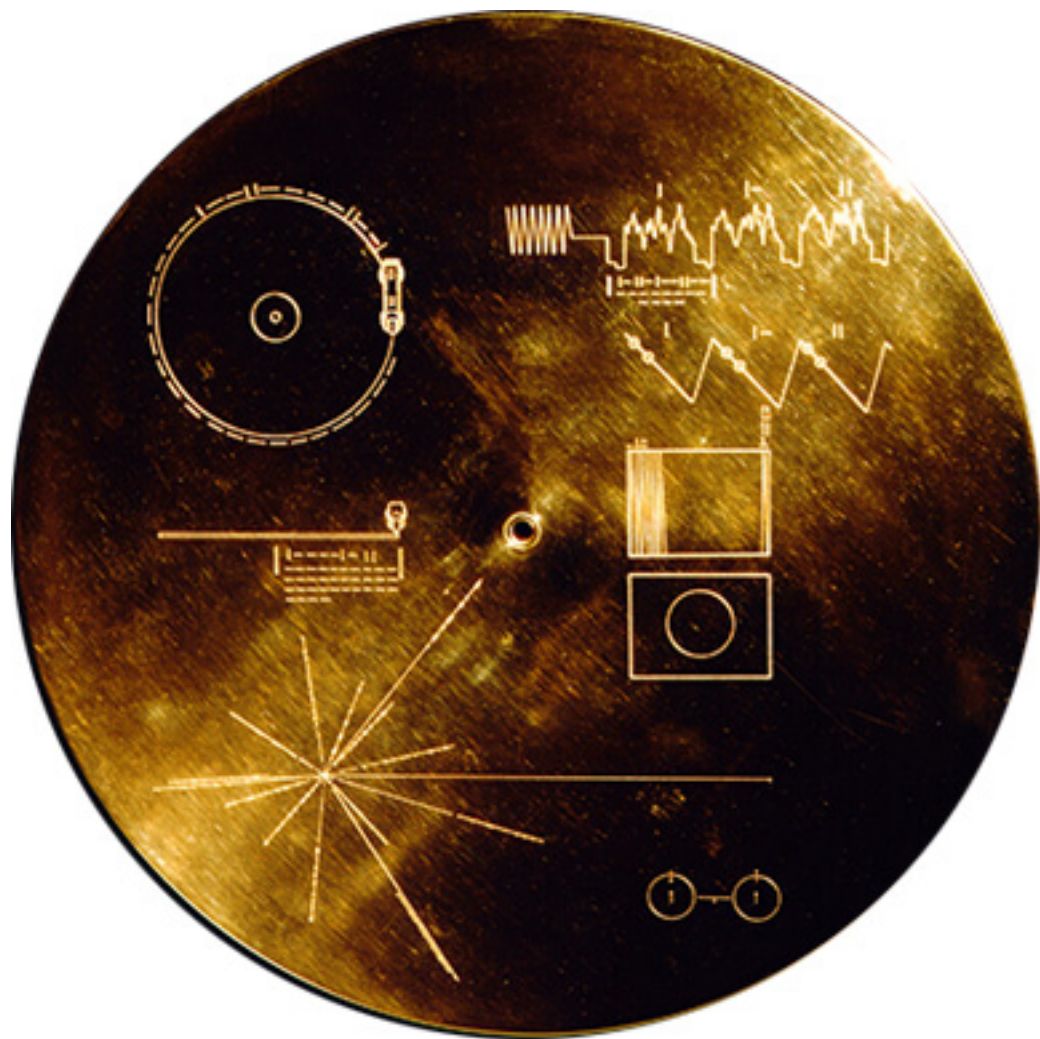
This boulder is the size of Curiosity

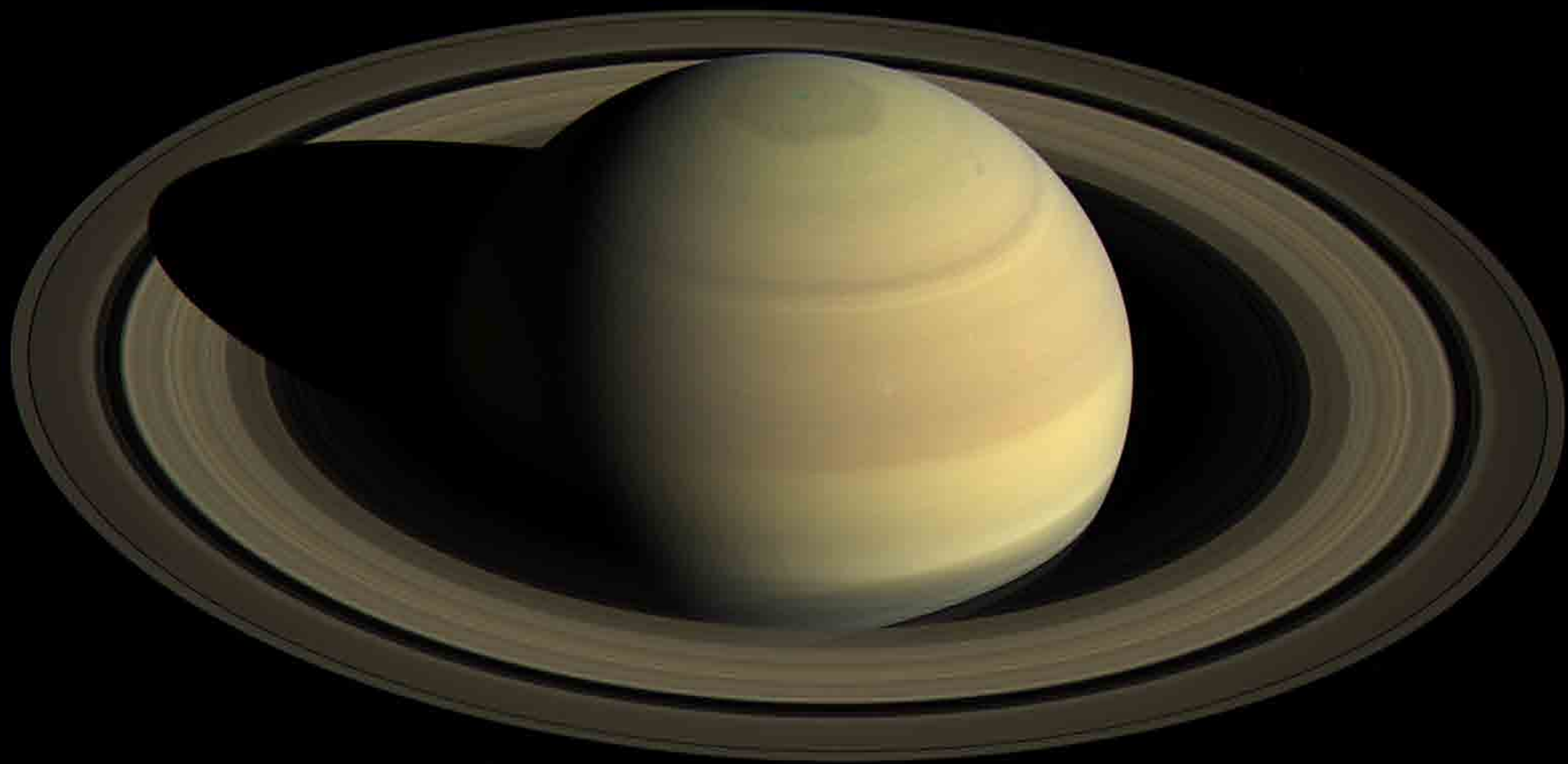


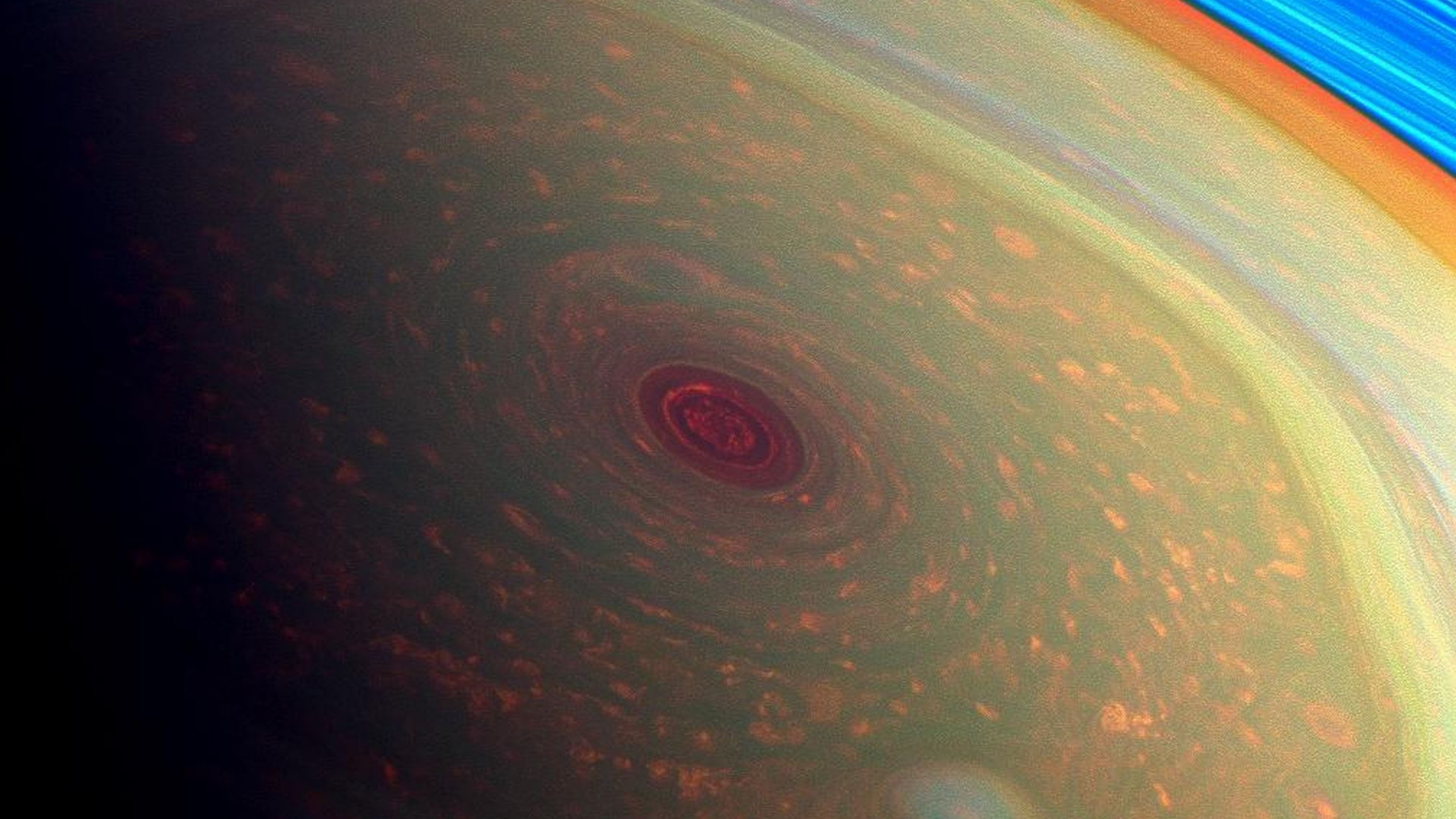
Captured by MRO

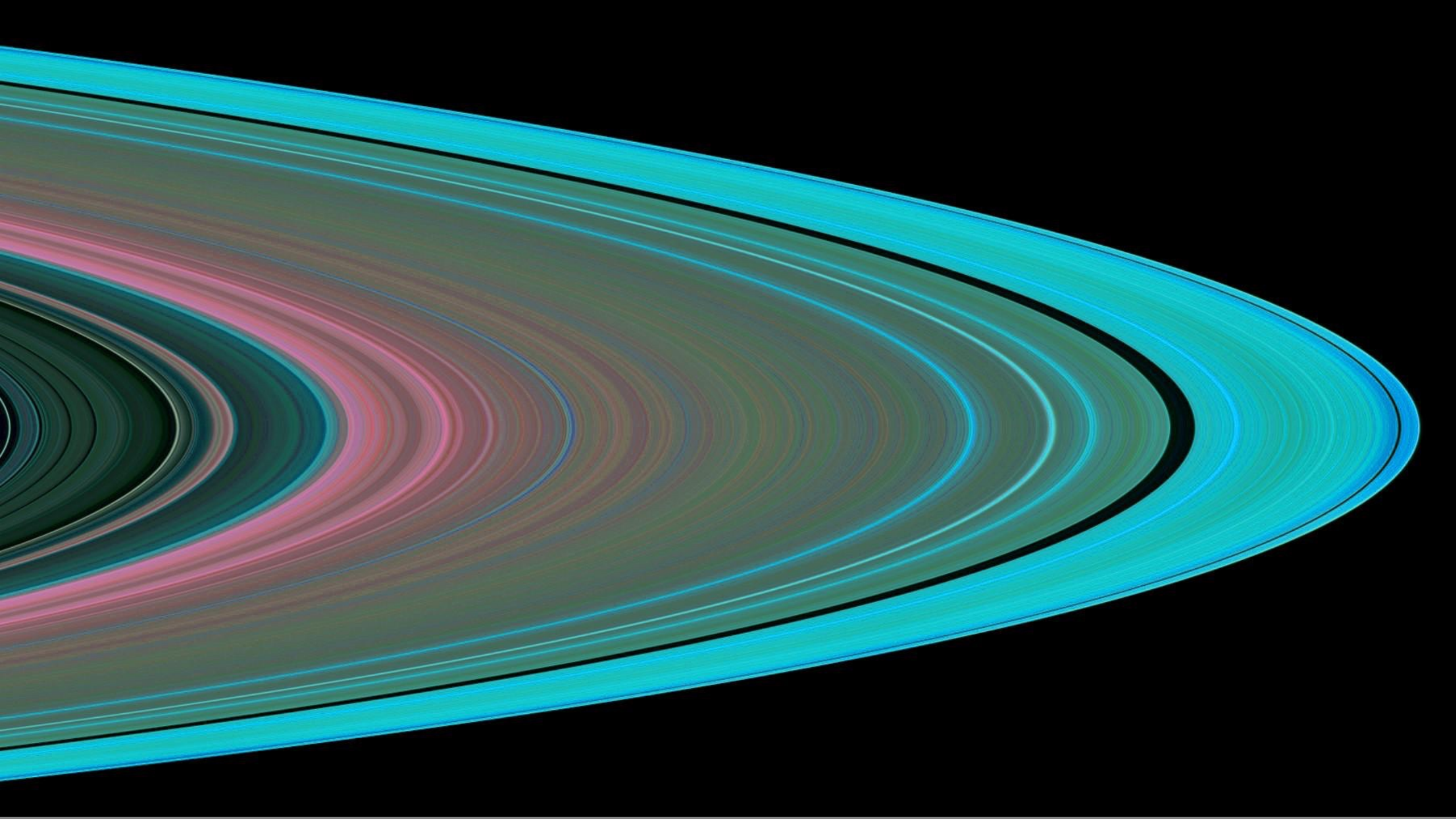


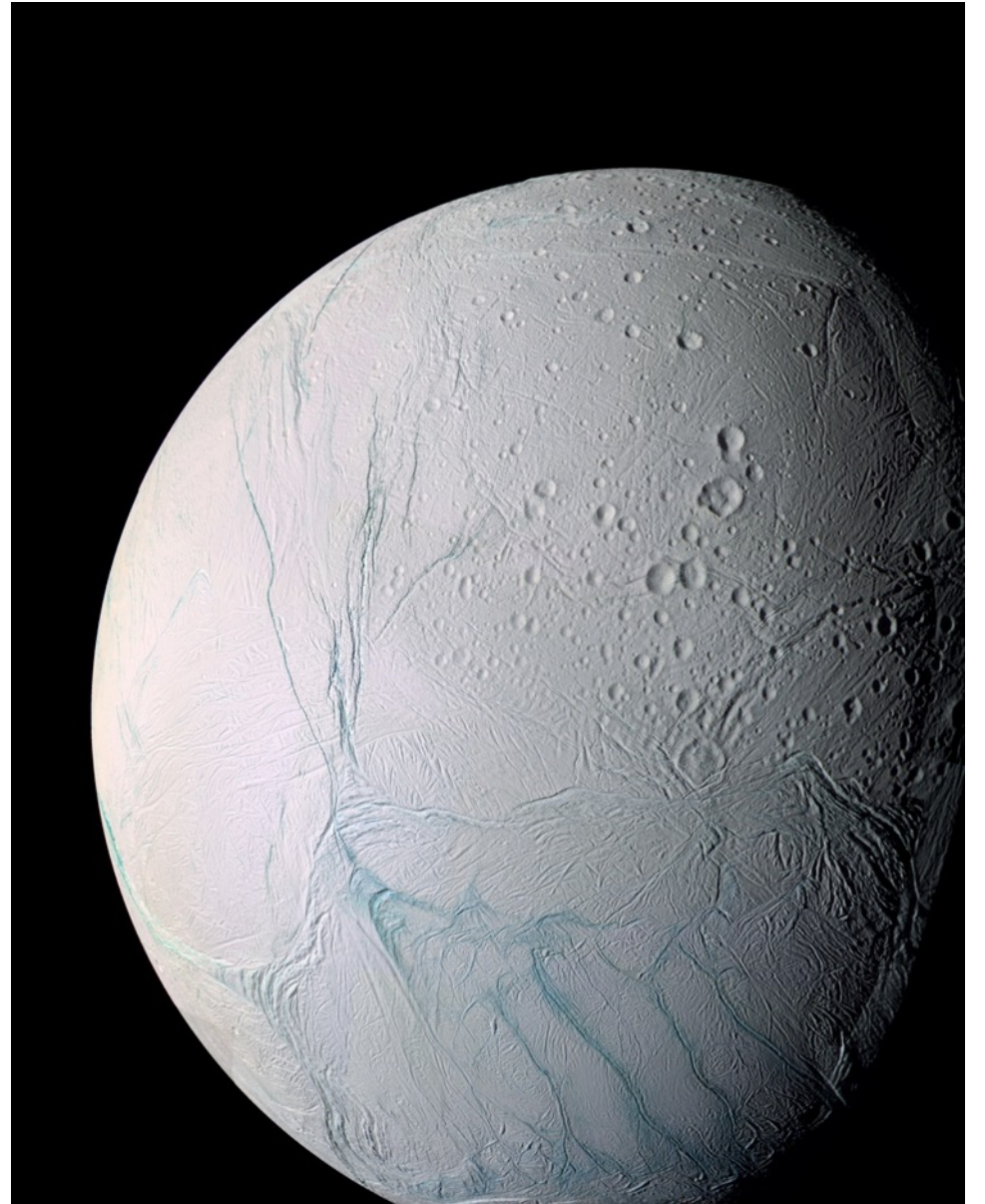
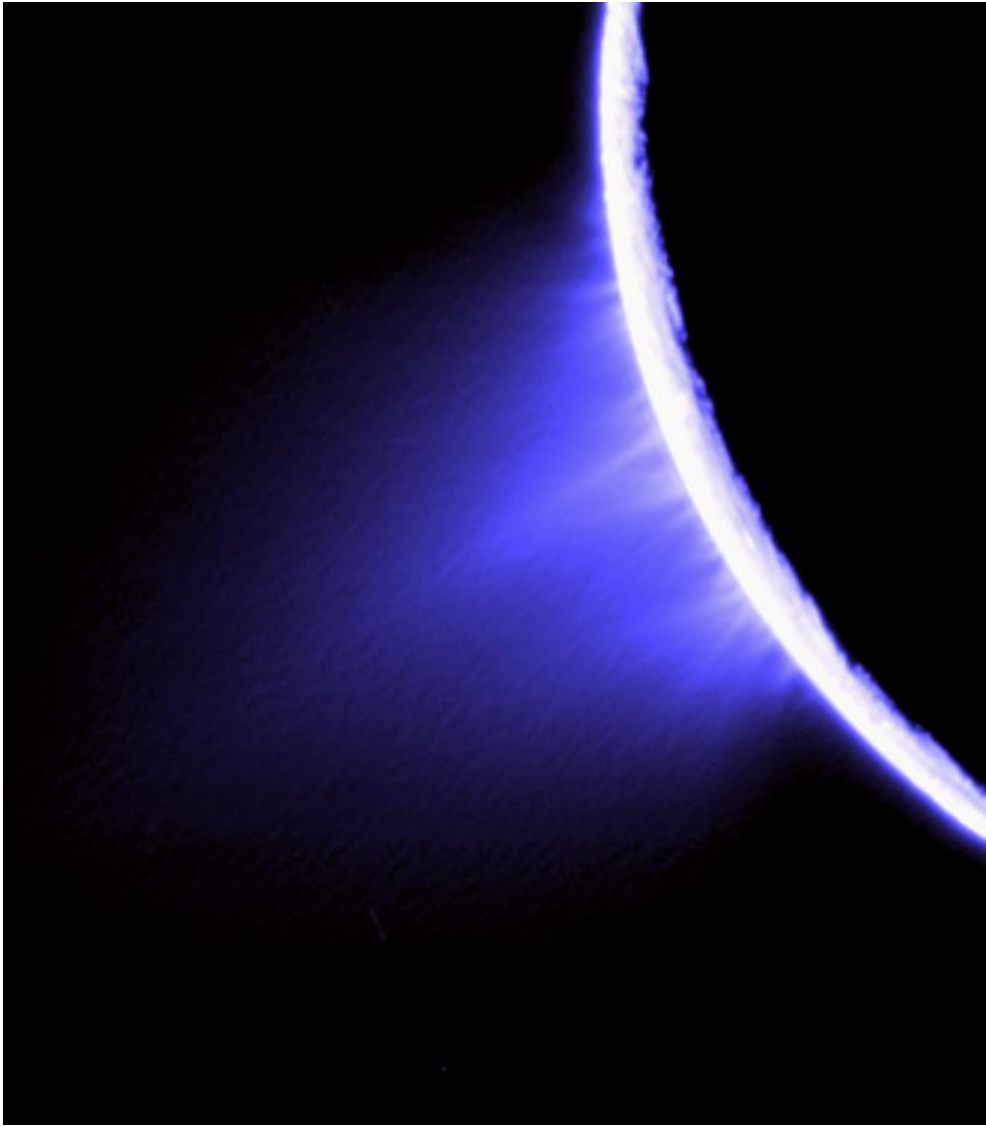


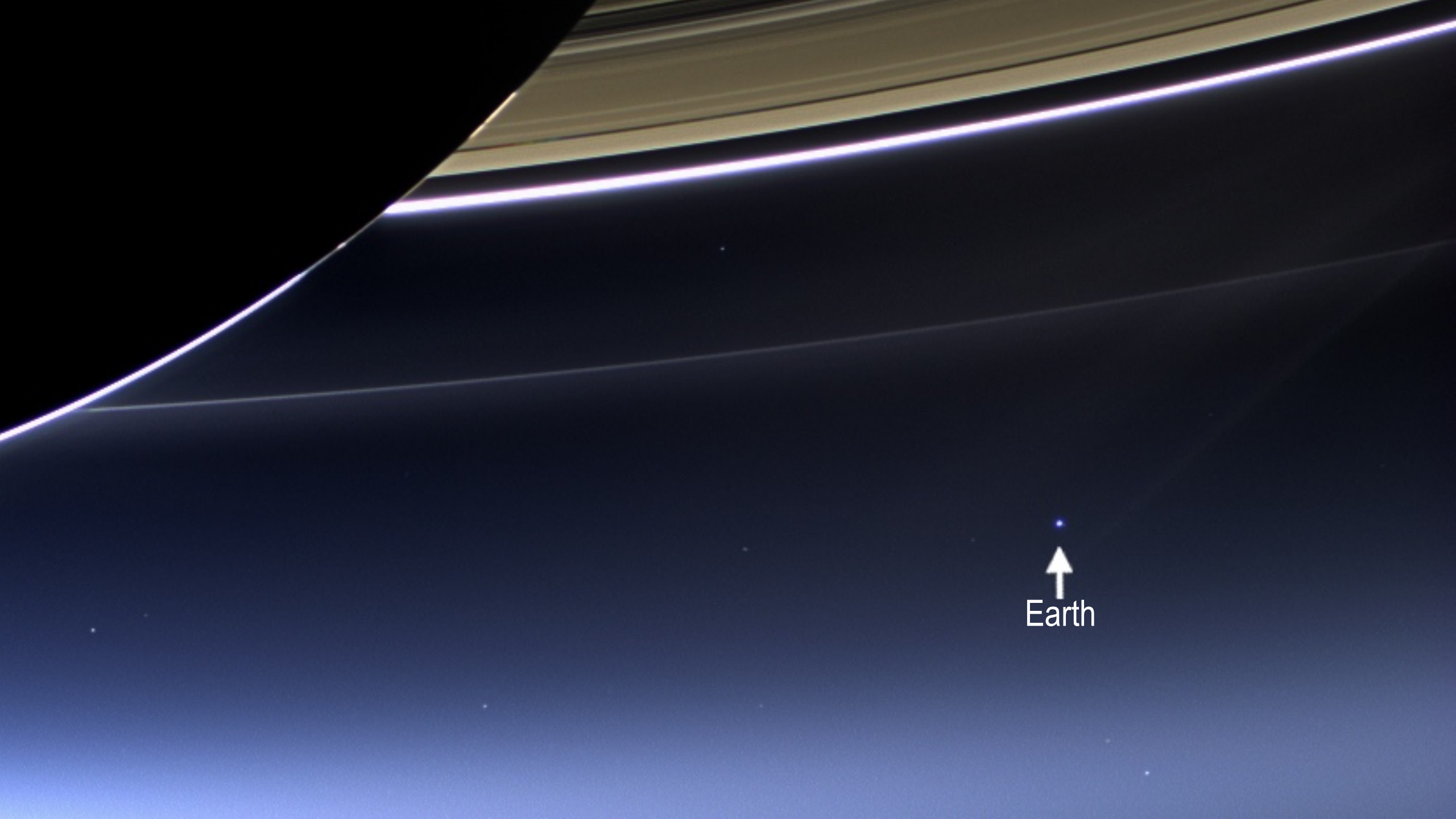






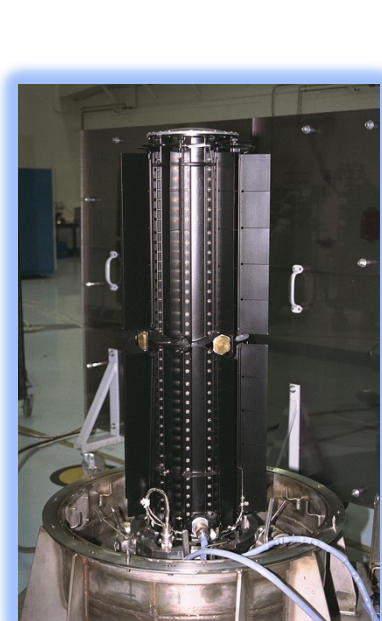




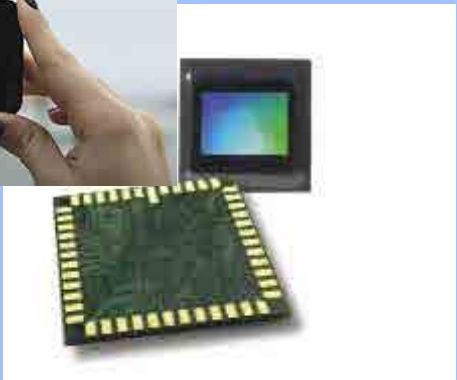


↑
Earth

What got us here ...



Radioisotope Power

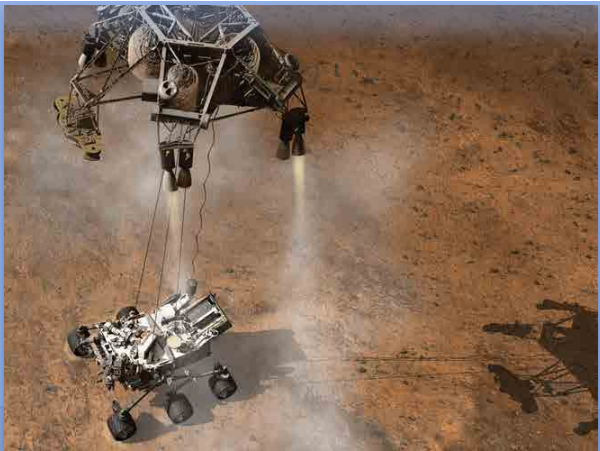


CMOS Camera

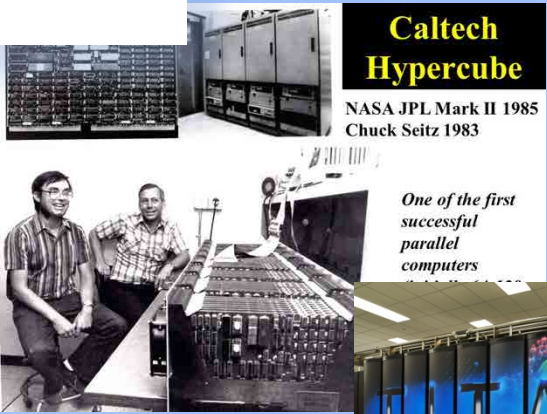
And Much More!



Cassini RF System



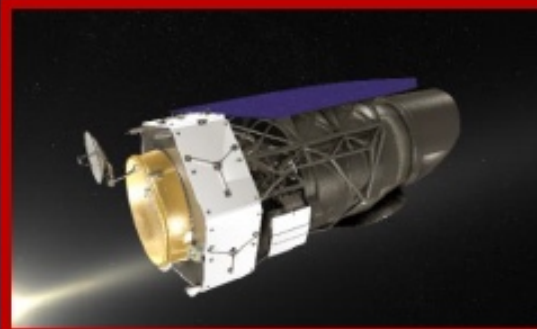
Mars Skycrane



Parallel High Performance Computing



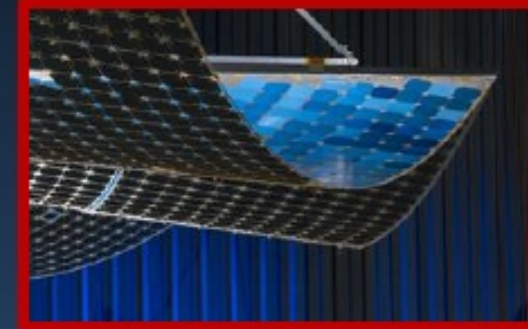
**Deep Space Atomic Clock
integration ready for launch**



**Coronagraph achieves TRL5,
resulting in measurements
100x better than existing tech**



**High Performance
Spaceflight Computing**



**Extreme Environment Solar
Power**

NASA STMD



**Deep Space Optical
Communications**



**Optical Communications
and Sensor (OCSD)
Demonstration**

The Aerospace Corp



**Integrated Solar Array
and Reflectarray
Antenna (ISARA)**



**ISARA
Deployed**

JPL and the Innovation Ecosystem

- JPL recognizes commercial space is expanding and is gaining momentum, in part due to a major increase in venture-backed startup companies
- JPL expects to increase interactions with the emerging start-up aerospace commercial sector
- JPL expects to explore the overlap between JPL's future mission needs and commercial opportunities with events like this
- This event is just the beginning



Today's Engagement

- Reliance on industry for project development
- SBIR and STTR Programs: Small companies
- NASA NIAC, grant and tech programs: Internal NASA and academia
- Tech transfer and licensing: partnering with externals
- Commercial Crew and Cargo: large NASA commercial projects
- Tipping Point Program: NASA–industry engagement



Emerging Business and Technology

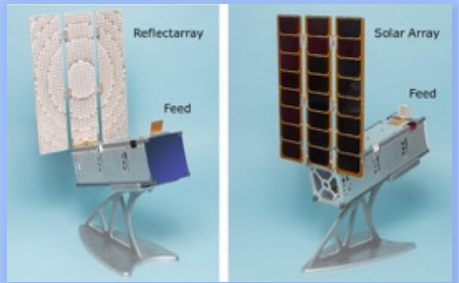
- New sectors growing in launch, telecommunications, remote sensing and tourism
- Emerging sectors in satellite servicing, on-orbit assembly and manufacturing
- 'Fourth Industrial Revolution' driving adjacent industries in self-driving cars, machine learning, AI that can broadly impact NASA missions



The future is now,
Let's continue to work together

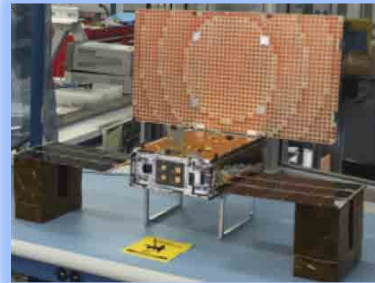


Thinking Differently on Deployed Antennas from Small Spacecraft



ISARA

- Ka-band
- 34×27cm



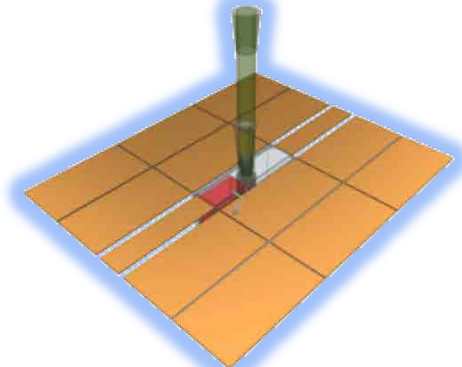
MarCO

- X-band
- 33.5×60cm



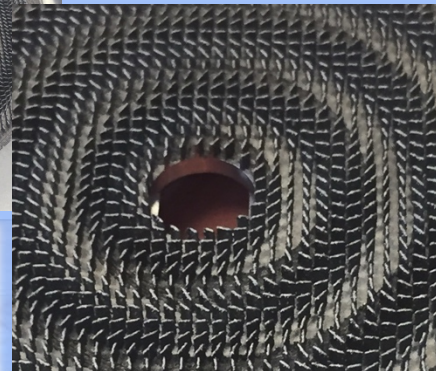
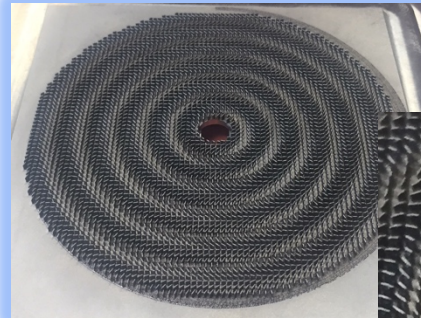
Raincube

- Ka-band
- 50 cm diameter



1-m Reflectarray

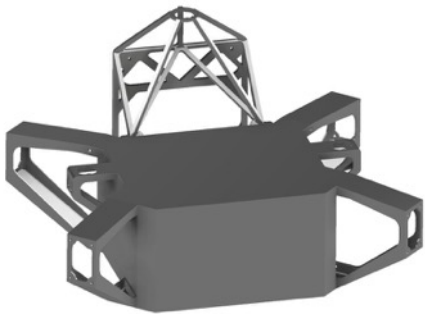
- Ka-band
- 100×100cm



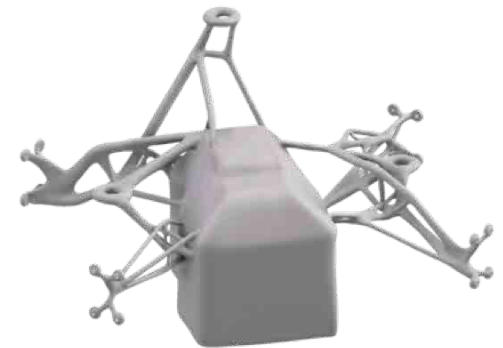
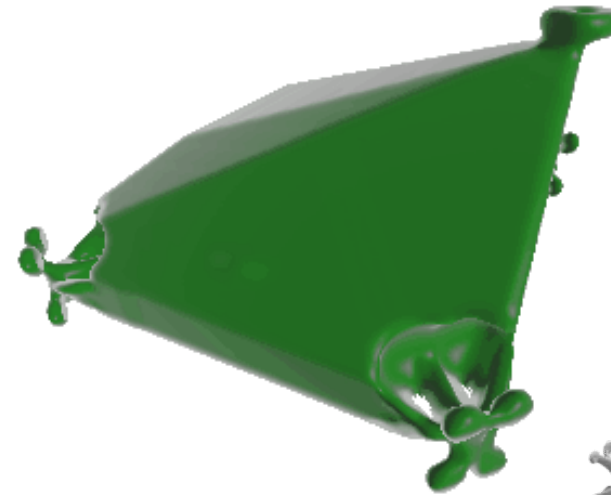
Metasurface Flat antenna

Thinking Differently in Digital Fabrication

Generative Software Design + Advanced Manufacturing



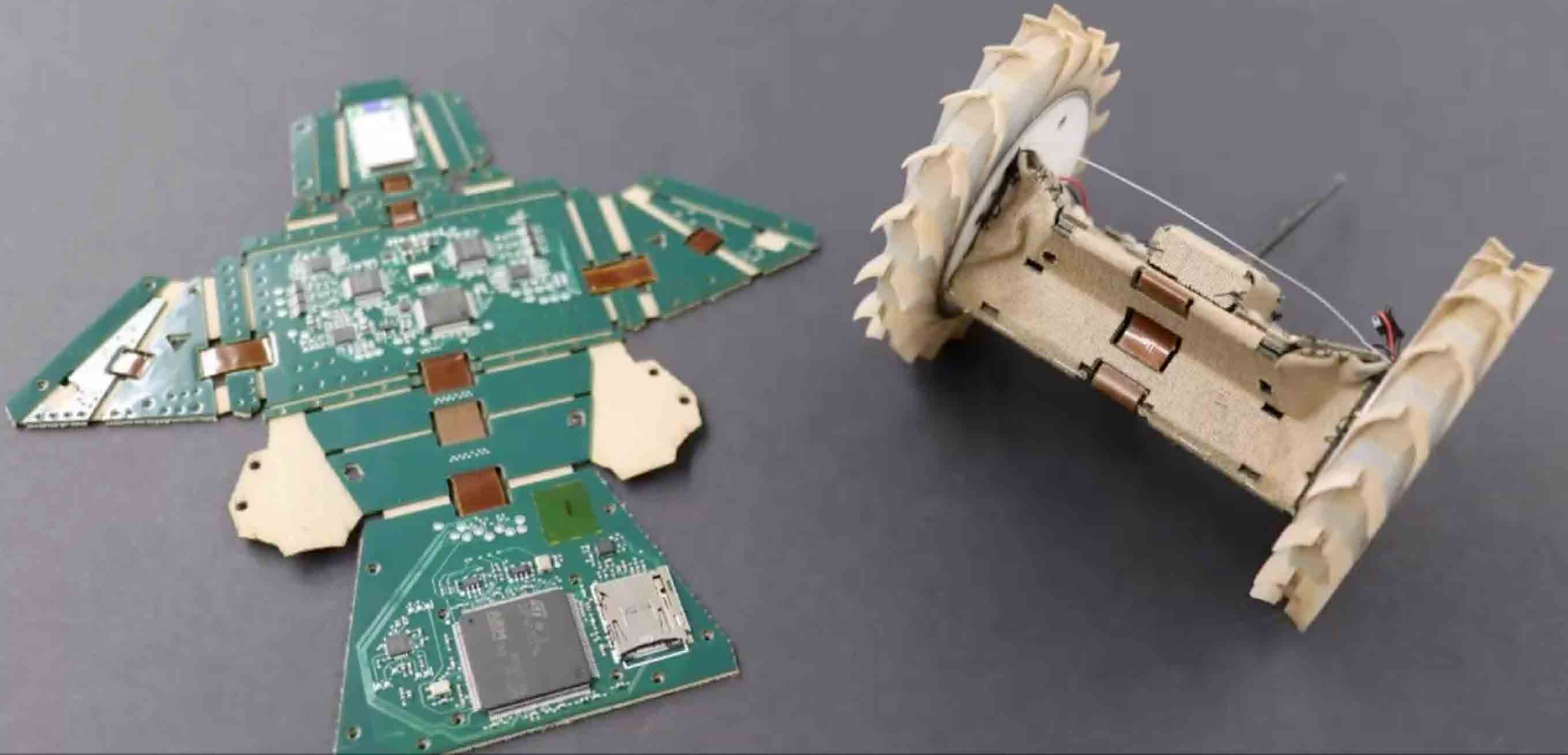
Baseline = 61kg



Solution = 47kg

PUFFER

Pop-Up Flat Folding Explorer Robots





Thank you!